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ABSTRACT

Included in this newsletter are reports on British science and mathematics educational activities such as a short course on chemistry for sixth form teachers and annual science and mathematics conference reports. Also included are reports on international conferences, meetings, and other activities. Finally, the newsletter contains annotated bibliographies of textbooks and periodicals, and of inexpensive science-teaching equipment. (BB)

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Science Education Newsletter

Issued by the
Education and Science Division
The British Council

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ACTIVITIES IN BRITAIN

1. THE SCHOOLS COUNCIL: N AND F PROPOSALS

The Schools Council is proposing a radical restructuring of the school examination system in England and Wales at the 18+ stage. The proposals are to replace the present system of GCE 'A' levels, in which a pupil normally sits for up to three subjects, with a 5-subject examination at two levels, N (Normal) and F (Further). An 'F' level syllabus would cover about three-quarters as much as a present 'A' level, and an 'N' level syllabus about half an 'A' level one. Pupils would normally offer two F levels and 3 N levels. The objective is to broaden the sixth form course and to avoid too much specialisation at sixth form level.

The proposals are currently the topic of public debate in England and Wales, and no decision on whether to recommend the change to the Department of Education and Science will be taken by the Schools Council until late in 1979. Meanwhile, extensive studies have been undertaken to investigate various possible forms of syllabuses and examinations that could be introduced under the suggested new structure.

Mathematics

In mathematics, a series of seven such studies have been completed, each undertaken by a different body concerned with mathematics education at the sixth form level. In summary, these studies are as follows:–

1. Mathematics and Further Mathematics; the University of London Examinations Board. Each of these two subjects would include pure mathematics, mechanics and statistics.

2. Pure Mathematics and Applied Mathematics; the University of Cambridge Examinations Board.

3. Core syllabus, and Options; the Mathematical Association jointly with Chelsea College.

4. Mathematics Applicable; an extension of the School Council's Sixth Form Mathematics Project, University of Reading.

5. Mathematical Investigations; the Association of Teachers of Mathematics.

6. Statistics; the Committee on Statistical Education.

7. Mathematical Awareness: the National Association of Teachers in Further and Higher Education.

Notes

i. Each of studies 1–3 would allow for the possibility of a pupil taking two mathematical subjects, as in the existing 'Double Maths' alternative at 'A' level, though of course with reduced total coverage compared with the existing situation.

ii. Each of studies 3, 4 and 5 represent new approaches to the style of sixth form mathematics teaching.

iii. Study 6 is a self-contained syllabus intended for students who need statistical techniques as a tool in other subjects. It would probably only be offered at N level.

iv. Study 7 is in the nature of a "mathematical appreciation" course at N level, and might be particularly attractive to eg potential primary school teachers who might otherwise leave school with a distaste for mathematics.

v. It must be emphasised that all this work is still simply in the nature of a series of feasibility studies. Even if the fundamental decision is taken to restructure the sixth form examination system on N and F lines, it does not follow that all or any of these formats for mathematics will be adopted, though it is likely that some at least would form the basis of whatever alternatives would be made available by the various examining bodies.

Science

In Science six studies have been completed by groups constituted in such a way that all the main bodies interested in Science education could contribute. Three possible models for the courses were envisaged:

Model A in which the F course did not depend on the N course.

Model B in which the F course consisted of the N course with additional content.

Model C an N course only.

The courses proposed by the groups are shown below:

1. Welsh Joint Education Committee: Physics – some core material common to N and F, additional material in both.

2. Association for Science Education: Physics – F course consisting of all N material and one double or two single additional studies.

3. Joint Matriculation Board: Chemistry – N course consisting of a common core with 2 short options: F course consisting of N material with extension core material or three short options.

4. Institute of Biology: Biology – F course consisting of all N material with additional core material and short option.

5. Cambridge Local Examinations Syndicate: Physical Science – F course consisting of all N material, and 2 options.

6. University of Sussex: Integrated Science – N course only (intended chiefly for those whose main interests were outside Science).

None of the groups found model A satisfactory.

2. ASSESSMENT OF PERFORMANCE UNIT (APU)

The APU has been set up by the Department of Education and Science "to promote the development of methods of assessing and monitoring the achievement of children at school and to seek to identify the incidence of under-achievement".

It is hoped that the results of monitoring will provide information to help determine national policy, including the deployment of resources, and help teachers, curriculum developers and others to plan programmes for pupils. It will be possible to compare the result for major groups of children eg in a geographical region, but not for individual pupils or schools. Work on devising means of assessment has begin in 3 subject areas, Science, Mathematics and Language.

In Science this involves the assessment of observation, selection, evaluation and the use of evidence, the testing of hypotheses, the use of experiments and the drawing of conclusions. Methods are being devised now and the first tests will take place in 1980.

In Mathematics, performance will be assessed within a framework of geometry, measure, number, simple probability and statistics and algebra. Understanding of basic concepts, the exercise of skills, and the ability to apply mathematical knowledge to everyday life, will be tested.

Both written and practical tests have been devised, and will be given in a random sample of schools each year, to pupils of 11+ and 15+. Between 10,000 and 12,000 pupils of each group will be tested annually, beginning in May 1978.

3. CHILD TO CHILD PROGRAMME

The Institutes of Education and Child Health, London University, are marking the International Year of the Child, scheduled for 1979, by collaborating in an international child health programme. Known as the **Child to Child** programme, it is designed to teach and encourage primary school children to concern themselves with the health of their younger brothers and sisters; this training will also be useful to them as future parents.

The children may be involved in three different ways:

i. **As part-time health workers;** the idea of the part-time health worker is now widely accepted. Many of the preventive and curative activities of these workers can be undertaken by schoolchildren with enjoyment.

An example of this is a programme in Indonesia, in which children are taught how to prevent severe illness or death from diarrhoea by giving mixtures of salt and sugar in water.

ii. **As older brothers and sisters caring for and entertaining their young siblings;** Older children already spend much of their time at home caring for their younger brothers and sisters. They can have fun providing them with a more stimulating environment, and helping in their development.

This can be done through acting, the use of puppets, playing games, gardening and so on.

iii. **As research wokers;** children already have a fund of valuable information. They can be encouraged to collect even more on the health of their family or community. For instance, in Bangladesh 100 health workers visit schools weekly, encouraging children to provide information about the small children in their family, including their illnesses. This knowledge is essential for planning in health and education.

Already a large number of countries are involved in this scheme, and have started their own programmes. An international workshop and conference was held in London from 13–19 April, in which many ideas were generated. It is hoped to publish a book, and produce a great deal of informative material; the essence of the programme is the exchange of ideas and experience.

A newsletter and further information can be obtained from the Director of the programme:

Duncan Guthrie
c/o Institute of Child Health, 30 Guilford Street, London, WC1N 1EH.

4. SCIENCE FOR THE LESS ABLE CHILD (See SEN 19.10): OPEN SCIENCE

This Project, which started in 1975, was one of the first locally based curriculum development projects to be funded by the Schools Council. A team of science teachers at the Science and Mathematics Centre, Birmingham, under the Project Director, F L Darrall, have produced material for less able pupils aged 14–16, who would probably not be entered for external science examinations. As the trials in 30 schools have shown, the most successful science teaching materials for this group of pupils are those highly relevant to their immediate experiences, and based on activities.

"Open Science" will be published in January 1979 by Hart-Davis Educational and Hutchinson. It consists of 13 pupil units, which are booklets 32 pages long, costing about 50p each. The units are independent of each other, and can be used in any order. They can provide a complete course, or can be used to supplement other material. The booklets can be used either as normal class books, with pupils working into their exercise books, or as work-books. Each topic is approached through a variety of practical activities.

Contents of the Units

Fire
Fire safety rules. What is a fuel? Putting fires out. Fabrics and flameproofing.

Safe Eating
Microbes and food. Safe cooking and storing of food.

Grow Your Own
Growing seedlings and houseplants. Transplanting. Simple hydroponics.

Life Spotting
Practical activities relating to local ecology. Surveying and identifying the distribution of animals and plants.

Structures
Making girders from cardboard and testing them. Making concrete and reinforced beams. What makes a structure rigid? Glueing and testing joints. Drilling and plugging.

Snaps and Circuits
Two aspects of communication: photography and electronics. Both are treated in a direct and practical way and need only the simplest materials.

Electricity in the Home
Electrical appliances. Reading meters. Wiring plugs and replacing fuses. Earthing.

Starting and Stopping
Activities on transport. Braking. Driving round corners. Skidding. Traffic speeds. Traffic flow.

Keeping going
Electrical wiring on cars and motorbikes. Roadsigns and traffic lights. Corrosion and de-icing.

Pollution
Air pollution – carbon monoxide, sulphur dioxide and solid deposits. Smoking. Noise. Water pollution and effect on life of ponds and rivers.

Find out about Machines
Simple machines such as tools and levers. Some ideas on classifying machines using a game. Force, distance and work.

Machines on the Move
The electric motor – principle and simple application. The car engine and how it works.

Science at Home
Simple scientific principles illustrated at home. Insulation. Flooring. Detergents and cleaning.

There will also be:

A Teacher's Guide, give practical advice on the teaching of each activity, with guidance for the laboratory technician.

Record Sheet Master Book, with record tables and some diagrams that would be time-consuming for pupils to copy into their own books; these can be duplicated by teachers for pupils within their own schools.

Further information may be obtained from:

Hart-Davis Educational, P.O. Box 9, Frogmore, St Albans, Herts, ALS 2BR.

5. SCIENCE LESSONS FROM INDUSTRIAL PROCESSES (SLIP)

There have been many attempts in recent years to bridge the gulf between education and industry; indeed "the education/industry interface" is fast becoming a well-worn cliché. As a result, science curricula tend to be more relevant now to the way in which scientific principles are applied in the world of work. However, of even more importance may be the establishing of links between schools and industries in a locality. One such scheme for getting teachers, and therefore their pupils, in contact with local industry started as a pilot scheme in Sunderland in 1976–77; it is now being tried out in modified form in other Local Education Authorities, notably Cardiff and Leeds.

The scheme, Science Lessons from Industrial Processes (SLIP), was the brainchild of the Science Adviser to Sunderland, Mr John Nellist, and was financed by the Local Education Authority and the Department of Industry. Its aim was to give a group of twelve teachers the time and opportunity to develop individual contacts with local industry. They would then look for possible links with their existing curricula, and produce teaching material suited to the needs of their own pupils. Its broader aim was cooperation which could have far-reaching effects for schools and industry. The teachers were given technical and audio-visual back-up.

Teachers were left to make their own contact with firms; not all first attempts were successful, but once firm contacts had been made, industrialists were found to be very helpful and cooperative. One company encouraged sixth formers to spend a day working in their laboratories, and lent apparatus to the school. A local paint factory helped a school reproduce, on a small scale, its factory process; as a result, a section on paint has been added to a CSE syllabus. A chemical firm has produced a booklet for visiting pupils, describing its plant in detail. By the end of the year, teachers had developed something of relevance to almost all sections and abilities in the 11–18 age range.

The modules developed by SLIP have been slotted into the school syllabuses, and now other teachers are being drawn into the scheme.

6. PROJECT-ENGINEERS AND TECHNOLOGISTS FOR TOMORROW (PETT)

P.E.T.T. is a Government/Industry/Engineering profession group set up to encourage school boys and girls to take up careers as engineers. In 1976/77 PETT held its first competition 'Young Engineer for Britain', open to groups or individuals, aged 16–19, in full-time education or working as apprentices. Competitors were asked to produce, with supporting documentation, a device or piece of mechanical, electronic or chemical equipment. The project could benefit industrial production, have commercial potential, cut waste, make better use of energy sources, or improve an existing process. After eleven regional finals, the national final took place at the University of Aston in September 1977. The prize winners included:

i. a group of apprentices from the Plessey Company, who devised FREDA (First Reprogrammable Electronic Disabled Aid), an electronic machine which helps children with cerebral palsy to coordinate their limbs, by responding physically to visual effects.

ii. a group from a school in Derby, who designed a central heating thermostat.

iii. Stuart McArthur, a school pupil who designed an aviary light and heat control.

iv. Roger Curry, a school pupil who designed an electrostatic high voltage generator.

The second competition of its kind, **Young Engineer for Britain 1978**, is being held; the finals will take place at the BBC Pebble Mill Studios, Birmingham, at the end of the year. Prizes for the winners and finalists include university and travel scholarships, job opportunities, a voyage in an oil tanker, and a visit to a North Sea oil rig. The address of PETT is:

Ashdown House, 123 Victoria Street, London SW1.

7. STEEL – SCIENCE, TECHNOLOGY AND ENGINEERING EDUCATION IN LANCASHIRE

S.T.E.E.L. promotes science, technology and engineering education by linking schools, colleges, industry, commerce and the general public through activities such as conferences, lectures and other information events. It conducts research in appropriate fields, stimulates curriculum development, arranges for the transfer of surplus equipment to schools and colleges where it is of use, and produces a twice-yearly bulletin, REALISM.

STEEL works through six Area Groups of teachers (at primary, secondary and tertiary level), technicians and other interested people. The coordinator is based at the Science and Technology Education Resource Unit at Preston Polytechnic, which offers advice and information to schools.

In the four years since it started, STEEL has engaged in a large number of activities. They include:

Contacts between Education and Industry, promoted particularly through conferences, meetings and curriculum development. Regional working parties of teachers and people from industry are exploring new approaches to teaching existing science course topics.

Curriculum Development, particularly in science for the 5–13 age group; in environmental science; in physical science for 14–16 years olds; and in astronomy.

Conferences, on 'Schools and Industry' and 'People, Industry and Production'.

Research, for instance in the attitudes of fifth year secondary school pupils to careers in industry.

Science Fairs and Exhibitions

Further information about STEEL and its activities may be obtained from:

The Coordinator, S.T.E.E.L., Chorley Campus, Preston Polytechnic, Union Street, Chorley, PR7 1ED.

8. MAKE IT COUNT: A FRESH START WITH NUMBERS

There are a number of well-established adult literacy programmes in Britain. By contrast, provision to combat the almost equally serious problem of adult innumeracy has been negligible.

A joint attack on the problem has now been launched by Yorkshire Television and the National Extension College. The NEC has printed a specially planned course, backed up by a Manual for Tutors, a set of Number Puzzles, and a Number Card Game. Yorkshire Television has produced a series of 13 programmes which have been broadcast weekly on all Independent Television channels in the first few months of 1978. They use large amount of film and graphic material to get across the idea of number in a concrete and everyday manner.

The printed material, while valuably supplemented by the television programmes, can be used on its own. It is aimed at those adults who have difficulty in understanding and using elementary processes in arithmetic, and who may even have problems in recognising numbers over about 20. The aim of the course is to create a new and positive attitude to number. Themes covered include number recognition, the four basic arithmetical operations, simple percentages, fractions and decimals, practical mathematics and aids to quick calculation.

The central concept of the material is that topics are graded in terms of real difficulty rather than in terms of apparent mathematical complexity. The book of puzzles and the card game have been devised to provide painless revision and practice in basic number operations.

Make It Count: Workbook £1.50 Puzzle Book £0.55 Card Game £1.25 Tutors' Manual £0.75 Tutor Training Kit £1.00 (Postage and Packing is additional). Obtainable from: The National Extension College, 131 Hills Road, Cambridge, CB2 1PD.

9. ASSOCATION OF TEACHERS OF MATHEMATICS: ANNUAL CONFERENCE 1978

The 1978 annual conference of the Association of Teachers of Mathematics took place at Padgate College of Higher Education, near Warrington, from 29 March to 1 April. There were roughly 200 participants, most of

whom were primary or secondary school teachers, but also including teacher educators, mathematics advisers and university lecturers. As usual, there were a number of visitors from other countries, including Germany, Poland, Sierra Leone, South Africa, Swaziland, Tanzania and USA.

Most of the conference programme was spent in working-groups, discussing a wide variety of aspects of the teaching and learning of mathematics at school level. Two major current issues in mathematics education in Britain featured prominently in discussion, the APU and the DES 'Enquiry'.

The Assessment of Performance Unit (APU) of the Department of Education and Science (DES) starts its first wave of testing in the Summer Term, 1978, in mathematics in the top classes of primary schools (see item 2 in this edition). Shortly before the conference, the DES announced that it was to set up an enquiry into mathematics education in England and Wales, in an attempt to take stock of the highly complex situation that now exists in schools. It is hoped to report on the progress of both these important developments in future issues of SEN.

10. THE MATHEMATICAL ASSOCIATION: ANNUAL CONFERENCE 1978

The annual conference of the Mathematical Association took place at the University of Bath, 5–8 April 1978. Among the 260 people who attended were visitors from a number of overseas countries, including Australia, Denmark, India, Nigeria, South Africa and Swaziland.

Among issues of current importance discussed at the conference were the work of the Assessment of Performance Unit (APU) of the Department of Education and Science (DES), and the series of studies in Sixth Form mathematics teaching commissioned by the Schools Council as part of their proposals for restructuring the school examination system at 18+ (see other items in this Newsletter, "N and F" and APU).

The retiring President of the Mathematical Association is Professor Geoffrey Matthews, formerly Professor of Mathematical Education at Chelsea College, University of London, and Director of the Nuffield Mathematics project. The President for 1978-79 is Mr Alan Tammadge, Headmaster of Sevenoaks School, and well-known for his work in the School Mathematics Project.

The next Annual Conference of the Association will take place in Hull, 18–21 April 1979, and the following one in Durham, 9–12 April 1980.

11. LONDON UNIVERSITY INSTITUTE OF EDUCATION: CHEMISTRY FOR SIXTH FORM TEACHERS

This course is intended to provide opportunities for bringing teachers into contact with some current trends in chemistry, both at University and A-levels.

The morning sessions will, in the main, be devoted to some new developments at University level and will be provided by academic staff of Birkbeck College, which is on an adjacent site to the Institute of Education.

The afternoon sessions will be devoted to topics of direct relevance to A-level chemistry teaching, and will take place in the new Institute of Education building.

Director of Studies

R B Ingle MSc, PhD. Department of Physical Sciences, University of London Institute of Education.

Enquiries, and applications by June to: Dept of Physical Sciences, University of London Institute of Education, Bedford Way, London WC1.

12. UNIVERSITY OF KEELE INSTITUTE OF EDUCATION: A RESTRUCTURED DIPLOMA IN MATHEMATICS EDUCATION

The course for the Diploma of Advanced Study in Education (Secondary Mathematics) has been restructured and may now include a newly introduced course on School Management. The Diploma course aims to extend and deepen the mathematical knowledge of the students, and to examine in depth some of the major issues in mathematical education, setting these in the wider curriculum context.

Programme

Students will take four courses:

1. **Educational theory and research design**

   An Overview in the main disciplines of educational study, with an introduction to research procedures in preparation for Dissertation work.

2. **Either Curriculum Development** – including curriculum theory, analysis of curriculum projects and of the problem of innovation.

Or School Management – a re-examination of theory and practice in organisational and management issues, both academic and pastoral. Topics will include the national and local context, decision making and resource allocation, team teaching and group patterns, the planning and evaluation of school activities and guidance services in school and community.

3. **Mathematical Education** – including topics such as psychology of learning mathematics, with practical investigations in schools; the nature of mathematics (with work at students' own level); the impact of the computer and calculator.

4. **Mathematics** – study of a selected area, chosen according to the interests, experience and previous knowledge of the student.

Entry Requirements

The course is normally open to qualified teachers who have a first degree in mathematics **and** who are qualified teachers with at least 3 years teaching experience. Candidates who do not meet these requirements may be admitted in exceptional circumstances.

Overseas students have in the past made a valued contribution to this and other parallel Diploma courses, and enquiries are welcomed.

For further information on the Diploma course – as well as on opportunities for postgraduate studies (M.Sc. one year full time course, M.A., PhD, by thesis) in mathematics education or science education within the Department of Education, contact Mr F R Watson, Institute of Education, University of Keele, Keele, Staffs. ST5 5BG.

13. MATHEMATICS CURRICULUM: A CRITICAL REVIEW (SEN 21.12)

The first three of the eight surveys of mathematical topics prepared by the project team are now available from Blackie. They are:

Geometry by W W Willson, price £3.75.
From graphs to calculus by H Neill and H Shuard, price £3.45.
Mathematics across the curriculum by J Ling, price £3.25.

14. PUBLICATIONS

14.1 Hong Kong Science Teachers' Journal Volume 5 No. 2 – December 1977

There are several articles which will have a widespread interest appearing in this copy of the Journal.

In particular an article about apparatus for the teaching of wave properties by Mak Seun Yuen of Wong Tai Shan Memorial College describes his use of low cost apparatus for such things as demonstrating transverse and longitudinal waves, and Melde's experiments which involves the coupling together of a ripple tank with an overhead projector.

Two other articles of interest are concerned with safety and hazards in laboratories. They are written by Dr J B Holbrook and Dr N Sammes of Hong Kong University. Finally there is an interesting discussion of the pros and cons of using radioactive substances for teaching purposes at O level in local schools; it is obvious that the Science Teacher's Association in Hong Kong is actively concerned about the conditions under which radium 226, strontium 90, cobalt 60 and plutonium 239 are going to be used for teaching purposes under local school conditions.

Enquires to: Hong Kong Association for Science and Mathematics Education, c/o Diocesan Boy's School, Mongkok, Kowloon, Hong Kong.

14.2 Kenya Chemistry Newsletter

This is a new journal presented by the Ministry of Education with financial support from May and Baker Limited and John Murray Publishers Limited which is edited by Mark Sinclair (Inspectorate Ministry of Education) and Mike Ratcliffe (Kenya Institute of Education) and intended for the information of chemistry teachers in Kenya.

This first edition does set a standard for the future, with for example an article on the place of chemistry teaching in local conservation programmes, and a discussion of the recent reforms introduced by the National Chemistry Panel of Kenya.

In yet another probing article, Professor P A Robins of the University of Nairobi enquires 'where have all the chemists gone'? and he gives a short survey of the fate of the chemistry graduates leaving the University. This article contains some useful facts and figures taken from University records.

Later in the journal, Barry Crawford, also of the University, introduces us to the Fog Index. This is an empirical way of assessing the readability of text books and other written materials. It is in fact, an assessment of the number of years of formal schooling required before one is able to read the passage under consideration.

Other articles discuss the UNICEF village technology unit, and the use of Alka Seltzer tablets for reaction-rate experiments. Examples of dangerous chemical reactions are discussed in some detail and there is an appeal for the creation of a local resources directory.

Obviously this new and lively journal will play an important role in bringing really useful information to many kinds of teachers especially those who have just begun their work in the teaching profession.

14.3 Physics Education – a journal of the Institute of Physics, London. Editor, R Schofield, Brunel University

This magazine is a major medium for the exchange of ideas on physics teaching, in schools, colleges, polytechnics and universities.

It provides clear explanations of new and established concepts in physics, and gives accounts of developments in physics curricula and courses. It also contains articles about physics in everyday life, industry and medicine, the history of physics, physics teaching in various countries, physics apparatus and experiments, and news and reviews.

There is a special annual courses issue of Physics Education listing all the university physics courses in the UK.

Physics Education is issued 7 times per year.

Subscription information

1978 Volume 13 7 issues		
United States, Canada and Mexico (air freight)		$ 42.00
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Paper edition £2.50 per issue
Archival microfilm edition
1966–77 Volumes 1–12 $265.00 the set

Orders should be sent to:

Physics Trust Publications, Blackhorse Road, Letchworth, Herts, SG6 1HN, UK.

14.4 Evaluation Newsletter – produced by Committee for Research in Teacher Education.

Evaluation Newsletter is edited by Robin Alexander (Leads University) and Roland Hoste (Stirling University) on behalf of the Committee for Research in Teacher Education

Its aim is to promote an exchange of ideas and information relating to strategies and procedures for evaluating courses in teacher and higher education.

Contributions to Evaluation Newsletter, whether entries for the register of evaluation activities, items of evaluation 'news', or longer articles, are invited from interested readers.

Subscriptions:	UK	£0.75 for three issues
	Other	£1.40 for three issues

Orders to: EVALUATION NEWSLETTER
National Foundation for Educational Research
The Mere
Upton Park
SLOUGH SL1 2DQ

14.5 **Chem 13 News and Phys 13 News**

Chem 13 News is an informal magazine published 9 times a year for secondary school chemistry teachers by the Department of Chemistry, University of Waterloo, Waterloo, Ontario, N2L 3G1. It is available free but readers are invited to contribute to costs. Letters, ideas and articles are welcomed by the editor. It contains articles, and short notes from teachers on theoretical and practical aspects of chemistry and letters, biographical notes, news of conferences, book reviews, problems and equipment advertisements.

Phys 13 News is a similar publication also available free, from the Department of Physics, University of Waterloo. It appears 5 times a year.

14.6 **In-Service Teacher Training in Developing Countries of the Commonwealth – A Handbook** by S Vivian, published by the Commonwealth Secretariat, 1977, price £0.75

The rapid growth of educational systems in developing countries over the past two decades and the need to introduce more suitable kinds of education have required, not only more and better pre-service training of teachers, but the provision of in-service training. The speed at which growth and change have been taking place has demanded large-scale efforts to retrain the mass of serving teachers who will continue to set educational standards for a good many years to come.

This handbook sets out to do two main things: in Part 1, to consider the many problems involved in the planning and carrying out of in-service programmes; in Part 2, to provide a number of case studies of recent significant in-service programmes from a variety of countries, which illustrate different ways of tackling the problems discussed in Part 1.

The programmes used as case studies are:

The Lesotho Primary Teachers' In-Service Programme (1966–1974)
The Montserrat Teacher Vacation Course in Mathematics (1973)
The Caribbean Mathematics Project (1971–1975)
The Kenya Headmasters' In-Service Programme (1968–1972)
The Uganda/UNICEF Teacher Upgrading Programme (1967–1970)
The Swaziland In-Service Teacher Training Project (1973–1978)
India: The Bombay Science Improvement Project (1970–1974)
Nigeria: A Primary Education Improvement Project (1969–1975)

Part 3 includes some observations and conclusions which the author feels can be drawn from the case studies cited and from other general experience. There is a useful bibliography.

As the author emphasises, this is not a complete "how-to-do-it" manual. The handbook has been produced to assist and encourage the sharing of experience in in-service training; as such, it will be of great value and interest to those concerned in this important area.

The handbook may be purchased from:

Commonwealth Secretariat Publications, Marlborough House, London, SW1Y 5HX.

14.7 **Mathematics 5–9: a Source Book of Guidance, Information and Ideas for Teachers;** David Lumb and Anne Papendick; John Murray, 1978; £2.50

This is a book for teachers of mathematics to children in the first 4 years at school. It presents the newer aspects of the primary mathematics curriculum in a realistic setting. Each theme is presented as a continuous development, so that a child can progress at his own rate while the teacher can see how each part of the course fits in to the whole.

An unusual feature of the book is that the concepts, together with appropriate classroom activities, are discussed on the left hand side of each page, while the corresponding development of language and recording is described on the right hand side. Stress is laid on practical work, though the equipment discussed is simple and inexpensive in the few cases where it cannot be made or collected locally. The book pays particular attention to problems of record-keeping in classes where children are not all expected to progress at the same speed as each other.

14.8 **Animals in Schools – Volume One: Vertebrates,** by Margaret E Hogg, published by Heinemann Educational Books, 1978, price £1.95.

This is a manual for teachers on the keeping, rearing and educational use of selected vertebrates in primary, middle and secondary schools.

The book contains sections on amphibians, the mouse, the the guinea-pig, the rabbit, the gerbil, and a particularly large section on tropical fish.

For each animal or group of animals, information is given on choice of equipment, care and maintenance, and on the selection, breeding, care and uses of the animals.

Each chapter gives many ideas on the educational uses of the animals described, under the headings: reproduction, growth and lifecycle; feeding; movement; behaviour; inheritance. The level of treatment is aimed mainly at the primary and middle school teacher, although behaviour and inheritance in some animals are treated at a more advanced level.

Although the text might benefit in places from more diagrams, and some of the photographs are rather dark, this is a useful handbook. It should be of particular value as an introduction for teachers and students with no previous experience of keeping and using animals in schools.

A second volume, on Invertebrates, is in preparation.

14.9 **Introduction to Biology, Colour Edition,** by D G Mackean, published by John Murray, 1978, price £3.95.

Readers of Science Education Newsletter need no introduction to "Mackean", in its original form or its two Tropical editions. These will, of course continue to be produced, but they have been joined by a new edition which has a large number of fine colour photographs.

The bulk of the text remains the same, but the use of colour has made it possible to illustrate some existing topics which cannot be adequately represented in black and white, and to add new topics. New subjects include adaptation, survival, insectivorous plants and unusual pollination mechanisms.

14.10 **Principles of Organic Chemistry** by P R S Murray Second Edition, 1977. Published by Heinemann Educationa, price £3.80.

The first edition prepared in 1972 was written by a practising teacher with A level, scholarship and first year university students in mind and the text contains an additional industrial and practical orientation which will meet the needs of national certificate in chemistry students. For example, the first section about organic chemistry principles contains as well as descriptions of atomic bonding, nomenclature, isomerism etc. A further section deals with the isolation and identification of organic compounds. In later chapters, these established principles of organic chemistry are applied to the different homologous series which are normally studied in a typical A level chemistry course.

In this new edition, the nomenclature of compounds is changed to meet the recommendations of the Association for Science Education and by and large this is a modern and consise treatment with an emphasis on general principles and their practical application.

14.11 **Advanced Chemistry Multiple-Choice Tests** by J G Stark, 1978. Published by John Murrary, price £1.25.

This is a collection of 15 multiple-choice test papers each consisting of 20 separate items and there is a final revision test of 50 items at the end of the book. The original test papers can each be completed in about 40 minutes and the main abilities tested recall information, the understanding of principles and their application to different situations.

A variety of multiple-choice question techniques are used and these include multiple-choice and completion items, classification and situation sets, assertion/reason items also.

The individual test papers deal with such topics as atomic structure, the periodic table, phase equilibria, reaction rates, topics in organic chemistry etc.

The usefulness and versatility of these tests is enhanced by the author's data on facility indices which are given together with the appropriate answers and mean scores at the end of the book. Altogether this is a reliable set of questions for use in both classwork and for revision purposes.

14.12 **Comprehension Exercises for Advanced Chemistry Courses** by J G Stark, 1977. Published by John Murray, price £0.75.

This is a useful contribution to chemistry A level teaching containing as it does 20 selected passages from recent published accounts of physical, inorganic and organic chemistry. For example, there are passages about the Ellingham Diagram, boron chemistry, the manufacture of phenol, chemical energy, the oxo reaction etc.

Each passage is followed by 10 short questions which can all be answered in about 45 minutes, a suitable time for a class period or a period of homework. The questions test a wide range of abilities and have been exposed in the author's classroom over a number of years with a variety of abilities.

Altogether, this is a useful book for the busy teacher who has a limited amount of time at his disposal for preparing homework exercises and it is of value as supplementary work for the use of high ability students.

14.13 **Modern Basic Physics by Harvey Johnson and George Sale,** published by Evans 1977, price £3.00

This book is intended primarily for East African students and includes the subject matter of the first years of SSP and the Kenya Junior Secondary examination syllabus.

Topics are introduced by reference to simple observations. They are then developed through investigation and experiment: the expected results are described and the basic facts established. The text is very fully illustrated and interspersed with "problems" or exercises to which the answers are given at the end of each chapter along with more formal questions.

OVERSEAS AND INTERNATIONAL ACTIVITIES

15. INTERNATIONAL COUNCIL OF ASSOCIATIONS FOR SCIENCE EDUCATION

At the General Assembly of ICASE held in Nijmegen on 2 April 1978 the following officers were elected:

President Mr Robert L Silver NSTA
Vice President Dr Rufus Alabi STAN

Executive Committee:

Regional Representatives –	Africa: Mr E Sawyerr SLAST
	Asia: Mr Malcolm Rosier ASTA
	Caribbean: Mr Winston King StVast
	Europe: Drs Wop Zandstra NVON
	North America: Dr Barbara Thompson FUSE
Co-opted members –	Mrs Sheila Haggis UNESCO
	Professor Charles Taylor/Mr John Lewis ICSU CTS
Appointments –	Mr Dennis Chisman, Executive Secretary/Treasurer (re appointment)
	Mr Jan Vaernewijck, Editor (re appointment)

There is a vacancy for a co-opted member to represent Spanish speaking associations.

Copies of the Directory of Science Teachers Associations Worldwide are available at $10 each to non members, $5 to members, from The Association for Science Education, College Lane, Hatfield, Herts, AL10 9AA.

The directory gives the name and address of the official correspondent for each of the member associations, the total membership, and a summary of services to members.

ICASE has also published "A Guidebook for Science Teachers' Associations" which is now available from Executive Secretary (ICASE) The British Council, 10 Spring Gardens, London, SW1A 2BN.

16. INTERNATIONAL CONFERENCE ON INTEGRATED SCIENCE EDUCATION WORLD WIDE 28 MARCH – 7 APRIL 1978

This major international conference sponsored by the International Council of Associations for Science Education (ICASE), UNESCO, the International Council of Scientific Unions (ICSU), and the Dutch Science Teachers Association (NVON) was held in the University of Nijmegen, Netherlands, under the Chairmanship of Dennis Chisman, Director Schools and Further Education Department, British Council, and Executive Secretary ICASE.

The conference was attended by about 270 participants from 50/55 countries from all regions of the world. It was essentially a working conference with participants working in discussion groups. These were organised in such a way that during the first half of the conference the working groups were mainly concerned with various aspects of integrated science education as practised at the present time, whilst in the second half of the conference the working groups were looking forward in time in an attempt to identify trends in integrated science education which might be developed in the 1980s. A short report on their findings is included here.

There were 5 plenary lectures on aspects of integrated science education, including an opening plenary lecture by Dr Jan Terlouw, a member of the Dutch Parliament and a former nuclear physicist. This was on the theme of science and society. A summary is given below.

In addition to the plenary lectures and working group discussions there were a number of poster sessions during which individual participants were able to present papers that had not been commissioned in advance by the organising committee, and there was also a display of books and materials submitted by individual participants and by commercial organisations.

The full proceedings of the conference will be published in due course in the UNESCO series New Trends in Integrated Science Teaching. It is hoped however to publish in the fairly near future full texts of the plenary lectures, together with summaries of the working group reports, as well as a list of participants. This smaller publication will be issued by ICASE; details will appear in SEN later.

The Working Groups

During the period of the conference, participants divided into several working groups to study ten major fields of interest with respect to integrated science curricula and the problems of implementation throughout the countries of the world. These interests included such topics as the design and content of integrated science courses, their aims and objectives, special problems in teacher education, evaluation procedures and the provision of resources for integrated science. The relationship with other curriculum subjects was investigated as were the special problems of disseminating and implementing the curriculum formulations.

Some of the more important points which emerged from these discussions were:

1. The integrated approach to science teaching is favoured more in the junior secondary school than as a desirable subject in the upper secondary school. It was felt that the course of study might reflect not only societal needs in terms of cultural and economic factors, but also make provision for process skills and inculcating attitudes which are more concerned with the needs of the learner.

Experienced field workers at the conference identified various key factors which can be made accountable in preparing integrated science curricula, for example the political system of the country must be considered, the culture, religion and financial state also. On the one hand national educational goals must be taken into account but there must not be a neglect of social relevance and statements by professional organisations who have an interest in school teaching. Other important factors are the qualifications and the facilities for further training of teachers, the laboratory and other school facilities where the course of teaching will be prosecuted; the expertise of the curriculum developers themselves in the local setting must also be taken into account.

2. Considering the training of teachers for integrated science, they need to realise the values which are inherent in their pupils to a greater extent then in subject centred teaching. They have to be prepared to take account of cultural and linguistic factors beyond the actual scientific content of the curriculum. A non-defensive teaching style is required often for the first time, together with new management skills in the classroom.

Teacher training should clarify the understanding of objectives in the curriculum and inculcate an adaptability to situations which can be exploited for teaching purposes. There is a need to stress the social relevance of science in teacher training and a much greater degree of interaction between the school, the student and the teacher training organisers should be fostered.

For the teacher in training, emphasis is placed on the art of managing mixed ability groups, the improvisation of equipment and practical activities, an awareness of the impact of traditional subject courses on the student's own view of science, and the integration of content and method.

3. Dr Harlen's paper about strategies for implementing integrated science at the primary level provoked some very interesting discussion. The group decided that science teaching by partly trained teachers should in fact begin even if all the curriculum goals are not immediately attainable.

Primary teachers need cooperation and sympathy for their efforts in this situation when they undertake an integrated curriculum for the first time. They can acquire useful experiences by participating in development and implementation programmes themselves. The provision of local materials sometimes collected by the children, the setting up of resource centres where teachers and parents can make equipment and the involvement of technical and industrial arts departments in the supply of equipment all give valuable support for the inexperienced teacher.

4. In reviewing evaluation, the meeting saw value in considering implicit as well as explicit objectives. This must be done at an appropriate stage in the life of the new curriculum and not for example at a trial stage when initial temporary difficulties will have an obvious effect on the outcomes of the evaluation. The evaluator can with profit be associated with the formulation of the new curriculum at an early stage, providing support and advice and removing some of the threat which comes with an evaluator from outside the system.

The special objectives of integrated science requiring evaluation centre around the experiences concerned with intentions (scope and interest), transactions (activity methods) and outcomes (problem solving, attitudes and interests). One should not forget to evaluate the teachers in relation to training and suitability as these factors play such an important part in the performance of the integrated science curriculum.

5. Resources for integrated science provided a discussion with a very practical flavour. New proposals put forward include the provision of an index of integrated science projects which would be made available on a world wide basis as a reference source for those seeking to adapt existing curriculum materials.

Similarly, an index of low-cost equipment prototype information would be very useful and a third scheme for the international evaluation of commercial equipment from different manufacturers would also be of great benefit for workers in developing countries who lack this kind of experience.

Some participants at the conference stated that ministry officials in their countries need curriculum implementation guides to provide simplified accounts which would enable them to assess the initial capital outlay, annual running costs and teacher training strategies etc.

6. The implementation of an integrated science programme carries its own special problems with it: the lack of adequate resources in terms of finance, manpower and laboratories; the resistance to innovation encountered at several levels; the constraints of the examination system; the lack of teaching expertise as well as the fact that knowledge of the curriculum may also be deficient in the local situation.

A working group is needed to carry out dissemination and implementation and it should contain teachers predominently, with science educators and a curriculum adviser as addition. A network of outside consultancies was proposed which would include such things as science teachers associations, teacher training colleges, industrial interests and representatives of the Ministry of Education itself. This group then went on to discuss the detail of the strategies whereby this working group would become more localised with the formation of sub groups.

International agencies can play a role in implementation but they should respond to local needs and be sensitive to local attitudes rather than bringing in their own formulations from outside the system. There are strong reasons for supporting regional and international cooperation in these matters to avoid duplication.

7. Mr John Lewis presented a working paper on science, society and trends in science education. A concentric model involving science for the enquiring mind, science for action, and science for citizens was developed. Science teachers have concentrated too much on the first of these in past activities.

Science and society as a theme for the education of that aspect of science which deals with citizens would emphasise the use of scientific knowledge as a benefit and also as a detriment to society. It would lead to a realisation of the finite nature of energy resources and provide experiences for decision making. There would be also an establishment of the constraints which affect the contribution of the scientist to society at large.

This brief account will indicate the nature of the far-ranging and animated discussions which were a feature of this integrated science conference in Nijmegan this year.

"Interaction of Science and Society – consequences for education" by J C Terlouw

Man has made himself dependent on technology, and even his ethics are influenced by it, but scientific developments do not occur spontaneously – they are the result of human decision. There is a need for

man the recognise the limitations of science, to control the course of development, to cooperate with one another, and to understand the dangers of technological advance.

The Science teacher, because he understands the scientific principles involved, is the best person to teach Science as a human and social activity.

Bibliography

A bibliography on integrated Science education was prepared for the Conference. A limited number of copies are available from School and Further Education Department, The British Council, 10 Spring Gardens, London, SW1A 2BN.

17. DIDACTA 1978

The 16th exhibition was held from 10 to 14 April last at the Parc Des Expositions in Brussels.

The display of all kinds of school equipment from crayons to close circuit television, together with displays by leading textbook publishers of their latest productions, attracted contributions from many leading European manufacturers and these were housed in 6 large halls on the enormous exhibition site in the centre of Brussels.

This particular exhibition provided an opportunity for the onlooker to compare different models of a particular product, for example an overhead viewer, in terms of quality, price and performance. Over 50 British commercial organisations participated in this year's activities.

Some of the interesting items on display included a 3 in one viewing system by Autec Audio Visual, 247 Humber Avenue, Stoke and this particular model includes direct screen viewing for group use, large screen projection for use with larger audiences and laterally inverted image back projection for general exhibition use. The machine uses 16 mm movie film which is produced from 35 mm transparencies and standard cassette sound with pulsing.

Nicholas Burdett Limited, 17 Ludlow Hill Road, West Bridgford, Nottingham, NG2 6HD had an interesting display which included the Derbyshire Primary Mathematics Scheme materials with an additional range of texture boards which complement their tactile bridges and colour touch apparatus.

Messrs Griffin and George Limited, PO Box 14, Wembley, Middlesex, HA0 1HJ were showing many of their products including an oxygen meter, an environmental comparator and a growth chamber. Chemists would be interested in the spectrophotometer with a chart recorder and a heated column chromotagraph. The air bearing turntable demonstrations also attracted many onlookers.

Messrs Philip Harris International Limited, Shenstone, Staffordshire, WS14 0EE also showed a range of their products which included a very useful microbiology kit and lever balances which are finding particular use in the development of the science curriculum at the primary level.

Osmiroid Limited, Gosport, Hampshire, PO13 0AL concentrated on active learning materials which are designed by teachers and tested in the classroom and some of these also include the provision of teachers' guides and workcards for the guidance of students.

Offord Scientific Equipment, 113 Lavender Hill, Tunbridge, Kent TN9 2AY make lenses, prisms, mirrors and other optical components. They are marketing a new secondary school microscope which can be suited to all levels of school work by converting the basic unit with more elaborate optical and mechanical systems for the more advanced work, for example, in the sixth form.

Invicta Limited, Oadby, Leicester, LE2 4LV and Taskmaster Limited, Morris Road, Clarendon Park, Leicester were displaying their versatile mathematics materials which includes such things as balances, games and metric measuring equipment. Both companies are advised by mathematics educators in the design of their products.

The display of materials by the exhibitors was complemented by a seminar morning which was organised by the British Council in one of the conference rooms in Hall 11. This particular morning was divided into a display of modern English language teaching with audience participation and a lecture about modern developments in British science education by Mr B T Chadwick, Secondary Adviser, from the Headquarters staff of the British Council.

There is no doubt that the British contribution in terms of materials and expertise presented a significant contribution to this international exhibition. The participation of the British manufacturers and publishers was seen as an attempt to invoke the additional use of British materials in foreign schools particularly in the European sector and the displays by the British manufacturers were organised as a joint venture by the British Educational Equipment Association.

18. REGIONAL SEMINAR ON PHYSICS CURRICULUM DEVELOPMENT – ASIA (CONVENED BY UNESCO-APEID AND RECSAM) 5 – 14 JANUARY, 1978.

The regional seminar on Physics Curriculum Development – Asia was officially declared open by the State Director of Education Penang on behalf of the Secretary General of Malaysian Ministry of Education, Tuan Haji Othman bin Malek, on the 5th of January 1978 at the new RECSAM complex Conference Hall. The welcome addresses were delivered by both Mr R R Singh (Director, UNESCO, Bangkok) and Mr Chin Pin Seng (Director, RECSAM).

Objectives: The main objective of this regional seminar was to review and exchange experiences of the current new/experimental physics curricula in the participating Member States at the secondary level of education, with a view to improving physics education as an integral part of science and technology education.

Participants: Participants were invited in their individual capacities from 12 Member States in the region covered by the Asian Programme of Educational Innovation for Development (APEID). The 12 member states participated in the seminar were: Afghanistan, Bangladesh, Burma, India, Indonesia, Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand.

Agenda: The items included in the Agenda were:

i. Review and discussion of the experiences in current new/experimental physics curricula in the participating countries at the second level education.

ii. The place and purpose of physicss in second level education.

iii. The role of laboratory/field work in physics education.

iv. Interface with other scientific disciplines and technology.

v. The role of modern teaching aids, particularly mass media and the techniques of distance teaching/learning.

RECSAM Staff: The RECSAM staff involved in this seminar were:

Mr Chin Pin Seng
Mr Tan Boon Tee

Some Recommendations:

1. The general objectives of Physics Education were outlined as follows:

1.1 Physics Education must attempt to describe the diversity of physical phenomena and Physics teaching must proceed from the concrete to abstract.

1.2 Physics Education must act as a vehicle for the inculcation of a scientific attitude.

1.3 Physics education must stimulate/satisfy the curiosity of the child in understanding his environment.

1.4 Physics teaching must aim at strengthening communication skills.

1.5 Physics Education must be functional, providing the opportunities and the tools to solve real-life problems.

1.6 Physics Education must be responsive to the manpower needs and geared to developmental goals of the country.

1.7 Physics Education must attempt to spread the physics culture to the general public.

1.8 Physics teaching must aim at providing students with practical experiences that improve skills, understanding and attitudes towards enquiry and learning.

2. Interface of Physics with Mathematics:

2.1 Physics teachers should try to understand the new trends in Mathematics.

2.2 Physics teachers should take the responsibility to provide specific Physics examples in Mathematics.

3. Integration of Science:

3.1 Attempt will be made to reach a total integration with subject discipline boundaries completely blurred.

3.2 Relevant social issues should be incorporated in Physics courses at the Upper Secondary school level with appropriate emphasis for the science and non-science students.

4. Interface of Physics with Technology:

4.1 Technology should be subsidiary to Physics as far as technological applications are concerned.

4.2 Practical applications in Physics teaching should include working with models, visiting, showing slides or working with actual devices.

19. WORKSHOP ON EVALUATION OF INTEGRATED SCIENCE AND MATHEMATICS PROJECTS, SEYCHELLES

A small international workshop was organised by the Government of the Seychelles, with support from UNESCO and the British Council, 13–17 February 1978. The purpose was to share experiences and problems in the evaluation of developmental projects in integrated science and in mathematics at the lower secondary level, with particular reference to developing countries in the Anglophone African region.

As well as representatives of the co-sponsoring bodies, there were participants from Ghana, Kenya, Lesotho, Mauritius, Nigeria, Seychelles and Swaziland. A striking feature of the workshop was the similarity of the problems faced by the participating countries at this level of their educational systems, and there was a great deal of exchange of information about the various countries' attempts to resolve them.

The work of the meeting provided an input to the International Conference on Integrated Science, at Nijmegen, Netherlands, March 1978 (SEN 34.22). It is hoped to follow up the mathematics component by convening a regional seminar to consider the problems of adaptation of teaching materials, in the light of the results of evaluation studies.

A bibliography of sources for evaluation techniques was prepared in connection with this workshop and copies are available from Schools and Further Education Department, The British Council, 10 Spring Gardens, London, SW1A 2BN (see also item 14.4).

20. INTERNATIONAL CONFERENCE ON DEVELOPING MATHEMATICS IN THIRD WORLD COUNTRIES

This important conference was organised by the University of Khartoum, Sudan, with the support of the African Mathematical Union. It took place in Khartoum, 6–9 March 1978.

The conference was notable both for the fact that it was entirely organised in and concerning developing countries, and for the very wide international participation which it attracted. Mathematicians and mathematics educators attended from North, Central and South America, the Caribbean, Europe, Asia and Australia, as well as from many African countries.

The work of the conference centred around four working groups concerned with School Mathematics, University Mathematics Institutions, Mathematics and Development, and Mathematics Policy and International Cooperation. A feature of the work of the first group was the agreement of the participants in their attitude to the traditional maths/modern maths controversy still raging in some developing countries. The relevant part of the final report, which deserves widespread publicity, reads as follows:

> "We consider that to regard 'traditional' mathematics and 'new' mathematics as a dichotomy is not a helpful way of discussing the curriculum. Many meanings are associated with each of these terms. More importantly, the syllabus is not the major problem."
>
> "We therefore recommend that any major development of school mathematics curricula must be preceded by adequate preparation of the teachers. The professional development of the teacher, and the improvement of classroom conditions, are higher priorities than further changes of syllabus."

In a word, the conference considered that the debate, country by country, should move away from both 'traditional' and 'new' mathematics, to focus and **good** mathematics teaching. It is hoped that the conference report and recommendations, coming as they do from mathematicians and educationalists of developing countries, will assist in this change of direction.

The Final Report of this most successful conference may be obtained from the Chairman of the Organising Committee, Dr M E A El Tom, Department of Mathematics, Faculty of Engineering and Architecture, University of Khartoum, Khartoum, Sudan.

21. CASME ASIAN REGIONAL CONFERENCE: NEW DELHI, INDIA, MARCH 1978

An Asian regional meeting of the Commonwealth Association of Science and Mathematics Educators (CASME) was held in New Delhi, India, 20–24 March 1978. All the Commonwealth countries of Asia were represented, participants coming from Bangladesh, Hong Kong, Malaysia, Singapore and Sri Lanka as well as from India itself. Members of the Council of CASME were present from Australia and from Britain, and the Commonwealth Secretariat was also represented.

The excellent local arrangements for the conference were made by the Indian National Council for Educational Research and Training (NCERT) under the general direction of the Department of Science and Technology.

The theme of the conference was "Relevance in Science and Mathematics Education". Lead papers considered this theme from the aspects of Relevance and the Child, Relevance and Society, Relevance and Technology, and Relevance and Resources. The bulk of the work was done in four working groups, which explored these aspects in greater detail and formulated recommendations for action.

The report of the conference will be published, later this year, jointly by NCERT and CASME. It will be available from The Secretary of CASME, c/o The Commonwealth Secretariat, Marlborough House, Pall Mall, London, SW1.

Conference participants were pleased to learn that CASME has now become one of the professional bodies formally associated with the Commonwealth Foundation, thus assuring its financial viability. The next major meeting is scheduled for 1980, the suggested theme being concerned with the professional quality of teachers. It is intended that this meeting will cater mainly for the Commonwealth countries of the Australasian and Pacific region. Meanwhile it is hoped to expand the annual CASME Award Scheme and to increase the circulation of the official journal of CASME, The Science Teacher.

At one point during the New Delhi conference, all the participants stood as a mark of respect to a former Vice-President of CASME, the late Mr Y Y Okot, formerly Chief Inspector of Schools in the Uganda Ministry of Education.

22. THE SCIENCE CENTRE, DOMASI, MALAWI, 1966–77

The Science Centre has produced a review of its activities since it was founded in 1966. In that year, it was decided to replace the Nature Study syllabus in Malawi primary schools by a General Science course, demanding a new approach to teaching.

The staff of the Science Centre started with basic research into concept development in Malawian children. One particularly interesting finding was that the test scores that Standard 8 children gained bore no significant relationship to the number of years of science teaching they had received; this could probably be explained by the fact that science taught in primary schools depended on rote memory, and there was little exploration of materials.

This preliminary survey was followed by the writing, testing and rewriting of units for teachers' guides for each standard. Since the new science required materials and equipment, the Science Centre produced them, with the help of students from the nearby teacher training college. New primary science materials were introduced first into Standards 5 and 6, then into Standards 7 and 8, and in 1972, into Standards 1–4. By now, revision of most of the materials has been completed. An evaluation of the programme is planned in the near future.

The whole review provides an interesting, though brief, account of the Centre's role in curriculum development, and in-service training and as a resource centre.

23. THE BOTSWANA, LESOTHO AND SWAZILAND MATHEMATICS WORK-CARD PROJECTS: EVALUATION (SEN 29.17; 31.13)

This is the fifth year in which selected secondary schools in Botswana, Lesotho and Swaziland have been teaching mathematics in their lower forms using work-cards instead of textbooks. Such a strategy is designed to cater for the wide range of speed and mathematical aptitude found in many classes in the early years of secondary school. It has a profound effect on classroom organisation and on the role of the teacher. The projects have provided much experience in these areas.

The Ministries of Education of the three countries requested the British Council to provide an independent consultant to conduct a thorough evaluation of the project in the latter part of 1977. Dr H Martyn Cundy, formerly Professor of Mathematics in the University of Malawi, agreed to undertake the task. Dr Cundy, who had previously evaluated the Caribbean Mathematics Project (see SEN 31.14a), has now submitted his reports to the Ministries of Education.

Copies of the reports, which were published by the British Council, are available from the Schools and Further Education Department, The British Council, 10 Spring Gardens, London, SW1A 2BN.

24. RURAL EDUCATION AND AGRICULTURE PROJECT (REAP): BELIZE

Discussions with teachers involved, the Project Manager (Mr E Raymond) and officials from CARE in this programme suggest that it is one of the most exciting and relevant developments in the educational field for some time. The ultimate goal is the development of an integrated day based on experiences drawn from activities in the school farm. In the nine pilot schools a school farm has been, or is in the process of being developed. Each unit consists of an Outdoor Education Centre (ODEC) building provided by CARE and approximately 1 acre of cultivated ground together with chickens and rabbits. The work on the farm is carried out by the children and profits on sales are "ploughed", figuratively speaking, back into the system.

The major educational subject areas are taught using the farm activities as the basis. The major benefit is that the children in the pilot schools have the opportunity to develop skills of valuable in a rural setting and at the same time develop cognitive and attitudinal skills considered essential in "good" education.

Some initial reaction from parents, who were apprehensive about their children's chance of success at the 11+ selection examination, were experienced. However, continued involvement of the community in the programme and a recent move to provide a separate examination for pupils following a REAP course have largely eliminated these criticisms. One of the most important side effects has been the community involvement in school life. The REAP schools are now a functional and integrated part of the community instead of isolated ivory towers.

Although the nine schools are under trial conditions, it is interesting to note that each is developing in different ways – partly due perhaps to varying soil types but mainly due to the personality of individual teachers.

This approach, of using teachers to develop their own material has the advantage of maintaining commitment, and whilst slower in productivity should be considered as the only possible approach for long term effectiveness.

25. THIRD INTERNATIONAL CONGRESS ON MATHEMATICAL EDUCATION (SEN 31.21, 33.24, 35.25)

The full proceedings of the 3rd ICME, Karlsruhe, August 1976 have now been published in the form of a 400 page book. It contains the main lectures in full, detailed accounts of the thirteen working Sections which comprised the bulk of the work of the Congress, and a record of the wide range of other Congress activities. Of

The Working Sections were:

Mathematics Education at Pre-School and Primary Level (Ages 4–12).

Mathematics Education at Upper Primary and Junior High School Level (Ages 10–16).

Mathematics Education at Senior High School, College and University Transition (Ages 15–20).

Mathematics Education at University Level (Excluding Teacher Training).

Adult and Continuing Education in Mathematics (with Reference to Correspondence Studies and Television).

The Training and Professional Life of Mathematics Teachers.

A Critical Analysis of Curriculum Development in Mathematics Education.

Methods and Results of Evaluation with Respect to Mathematics Teaching.

Overall Goals and Objectives for Mathematics Teaching (Why Do We Teach Mathematics?).

Research Related to the Mathematical Learning Process.

A Critical Analysis of the Use of Educational Technology in Mathematics Teaching.

The Interaction between Mathematics and Other School Subjects (Including Integrated Courses).

The Role of Algorithms and Computers in Teaching Mathematics at School.

Of particular interest to many readers of SEN will be the account of the Working Group on "Mathematics in developing countries: the needs of the average student" which is summarised below:

Many more pupils, of a much wider range of ability, are now receiving secondary education in developing countries. The curricula textbooks and examinations were originally designed for a small, highly selected, academic minority, and these now need diversification. With increased enrolments the pass-rate for the final secondary school examination is declining, slighter faster than average for mathematics. The tendency is to blame "modern mathematics" but there is no evidence to support this.

The shortage of well qualified Mathematics teachers is acute, and the chief hindrance to curriculum development. Short in-service training courses are not adequate to develop the confidence of the teachers already in the schools to teach a new course. A better strategy has been developed in the Caribbean and in Botswana, Lesotho and Swaziland where classroom teachers have been involved in producing new materials, testing and revising them.

The need to give the central role in curriculum development to classroom teachers was one of the major emphases of the Congress. Teachers thus gain experience in identifying their students' needs and selecting methods and materials suited to them. They may then introduce small – group or individual work and embark on a new style of classroom management.

Alternatives to the present final secondary examination were discussed. In some cases the examination might be changed to suit the majority of the students, or the British system of multi-level examinations might be adopted. An external examination at the lower secondary stage might serve as a school-leaving certificate for a large number of students.

The group could suggest no uniform way of making mathematics education relevant to the majority but benefitted from the exchange of ideas and experiences. They recommended that the special needs of developing countries should be given priority at the 1980 Congress.

"Proceedings of the Third International Congress on Mathematical Edueation": edited by Hermann Athen and Heinz Kunle; distributed by Zentralblatt fur Didaktik der Mathematik, Universitat (West) Karlsruhe, Hertzstrasse 16,7500 Karlsruhe, Federal Republic of Germany: price 15DM.

26. TECHNICAL EDUCATION AND INDUSTRY: Commonwealth Seminar in Nigeria

Senior representatives of government and industry in Commonwealth African countries will meet in Ibadan, Nigeria, from 24 April to 5 May to discuss ways in which they can work together to improve technician training.

The seminar will discuss how governments can encourage industries, both state and private, to train personnel up-to and even beyond their own staffing needs. The scope for Commonwealth co-operation will be explored.

Working papers will deal with partnership at the national level and between educational institutions and industrial enterprises and with technical education in industrializing societies.

27. INEXPENSIVE SCIENCE TEACHING EQUIPMENT – a bibliography

A short bibliography of documents relating to the production of inexpensive science teaching equipment is included in this issue of SEN. Please see page 21, which is detachable.

INEXPENSIVE SCIENCE TEACHING EQUIPMENT – a bibliography

'Collection of apparatus assignments' by participants of course TC-01 (Training in development of primary science/mathematics apparatus).
Penang 1976.

Description of apparatus developed on course with suggestions for its use.

From RECSAM, Penang, Malaysia.

'Collection of assignments by participants of RME-1 Course (The Development of primary Science/Mathematics Apparatus)'.
Penang 1973.

Description of prototypes of apparatus made on the course, with notes on their use.

From RECSAM, Penang, Malaysia.

'Construction and use of simple physics apparatus' by Simpson.
Hong Kong 1972.

The apparatus described can be easily constructed from local materials.

From Hong Kong University Book-store, Hong Kong. Price HK$5., UK £0.50 or USA$1.50.

'Elementary Economics experiements in Physics i-IV' by Melton.
London 1972.

I Administrator's Guide includes workshop and laboratory plans and methods of production.

II Teacher's Guide and III Student's guide present a series of experiments for an introductory physics course.

IV Apparatus guide gives detailed instructions for production of simple flow cost apparatus.

From The British Council, 10 Spring Gardens, London SW1A 2BN.

'Eve Science Revision' and 'Illustrations'.
New York 1972.

A list of equipment required for primary and secondary science, and teacher training, and the price if obtained from UNICEF: the 'Illustrations' are of the separate items.

From UNICEF, The United Nations, New York, 10017, USA.

'Guidebook to constructing inexpensive science teaching equipment': Vol I Biology, Vol II Chemistry, Vol III Physics'.
Maryland 1972.

Construction plans for both basic and specialised items of equipment.

From Dr J D Lockard, Inexpensive Science Teaching Equipment Project, Science Teaching Center, University of Maryland, College Park, Maryland 20742. Price USA$10.00.

'Laboratory manual: schools and intermediate colleges'.
Lahore 1975.

A handbook of advice on the planning, equipping and use of laboratories.

From National Educational Equipment Centre, Wahdat Colony, Lahore, Pakistan.

'Low Cost Science teaching equipment'.
London 1977.

Report of a seminar/workshop in the Bahamas concerned with the production, maintenance and use of low-cost equipment in the Caribbean in the light of experience elsewhere.

From the Commonwealth Secretariat, Marlborough House, Pall Mall, London SW1Y 5HX. Price £1.00.

'New UNESCO Source book for science teaching'.
Paris 1973.

Suggestions for simple home-made equipment for a large number of experiments.

From UNESCO, 7 Place de Fontenoy, 75700 Paris, France or your national UNESCO agent (UK agent – HMSO price £5.40).

'Physics Kit: mechanics and general physics' and 'Physics Kit: heat'.
Nairobi 1972/75.

Practical workbooks for secondary school pupils based on equipment produced by SEPU.

From Production Unit, Kenya Science Teachers' College, PO Box 30596, Ngong Road, Nairobi, Kenya.

'Preparation for understanding'.
New Delhi 1975.

Ideas for teachers of young primary classes to help children discover the patterns and arrangements of the world around them using their hands, senses and minds; written as though addressed to the children.

From UNICEF, Education Section, 11 Jorbagh, New Delhi 110003, India.

'Primary Science Experiments with local resources'.
New Delhi 1976.

Instructions for teachers of primary classes to enable children to make apparatus and perform experiments: written in words addressed to children.

From UNICEF, Education Section, 11 Jorbagh, New Delhi 110003, India.

'Production of school science equipment' by Warren & Lowe.
London 1975.

A critical review of developments in low-cost equipment production and a summary of available resources.

From the Commonwealth Secretariat, Marlborough House, Pall Mall, London SW1Y 5HX. Price £1.25.

'Production technology Vol I'.
Lusaka 1975.

Construction drawings of basic items of laboratory equipment.

From JETS of Zambia, School of Engineering, University of Zambia, PO Box 2379, Lusaka, Zambia.

'School Science Equipment: report of a regional seminar.'
Bangkok 1973.

A survey of problems of design, prototype manufacture, mass production, marketing, distribution and use of science equipment.

From UNESCO Regional Office for Education in Asia, Bangkok, Thailand.

'Using Science Apparatus'.
New York 1974.

A description of the use and maintenance of the majority of items listed in the Eve Science Revision list for upper primary and lower secondary pupils: simple instructions for pupils are included.

From UNICEF, The United Nations, New York 10017, USA.

The British Council
10 Spring Gardens
London
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